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OXC-0314-68
Copy 7 of 8

12 April 1968

MEMORANDUM FOR THE RECORD

SUBJECT : Air Abort [redacted] 25X1

REFERENCE : [redacted] 25X1
25X1

1. The undersigned has studied the available information regarding the referenced incident involving [redacted] on 25X1 [redacted] and has compiled the attached review. This review includes available information regarding both the recent incident and background information regarding [redacted] previous cases of suspected decompression sickness. Also included is a brief review of information and case histories from the literature, a summary of this case, and recommendations.

2. The attached review represents the opinion of the undersigned and is presented as such for the record.

[redacted] 25X1
ASD/R&D/OSA

Attachment - 1
As stated above

25X1 ASD/R&D/OSA/[redacted] (12 April 1968)
Distribution:
orig - ASD/R&D/OSA w/att
2 - D/R&D/OSA w/att
3 - D/SA w/att
4 - D/O/OSA w/att
5 - OXC/O/OSA w/att
6 - PD/Compt/OSA w/att [redacted] 25X1
7 - ASD/R&D/OSA (Chrono) w/att
8 - RB/OSA w/att

USAF review(s) completed.

Logged 18 Apr 68

[redacted] 25X1
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A CASE FOR THE "CHOKES"

1. Recent Incident; [redacted] 25X1

A. Subject had been airborne for 57 minutes, breathing 100% oxygen at a maximum cabin altitude of 26,000 feet when he experienced sudden onset of left substernal pain with radiation to the left anterior and lower rib cage. He did not feel short of breath, but was unable to take deep breaths due to increase in chest pain. The subject reported symptoms and was instructed to inflate his pressure suit manually which he did. There was no immediate relief of symptoms, but apparently there was a diminution of the pain some minutes after the pressure suit was inflated. The subject returned to base and was on the ground approximately 32 minutes after onset of symptoms. Subject was examined at that time with no abnormalities except symptoms of pain which persisted for approximately 30 minutes before complete relief.

B. While the attending physician noted no other signs, the base Commanding Officer, who was also present, stated the subject was pale for an extended period of time after reaching the ground. The subject stated, during follow-up examinations, that he was very anxious/apprehensive during the incident--beyond what he felt the symptoms warranted--and felt that he must descend as soon as possible.

C. X-rays, lab studies and physical examinations on the day and the following day were normal. WBC count was elevated, with normal differential.

D. Information given by the subject and attending technicians indicated that 100% oxygen was breathed without interruption for 40 to 50 minutes prior to aircraft take-off. All personal equipment functioned satisfactorily and the oxygen supply was free from contamination.

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E. Two days after the incident the subject was taken to 26,000 feet simulated altitude in a chamber without any preflight denitrogenation. He was held at that altitude, breathing 100% oxygen, for approximately 10 minutes before return to ground level. No problems were encountered.

2. Background Information on this Individual:

A. In June 1967 subject experienced gradual onset of mild to moderate deep discomfort in right knee joint, which was aggravated by rubbing or movement of the leg. Total duration of symptoms was approximately 5 to 10 minutes and was associated with a mild parasthesia of the skin over dorsum of back. The symptoms occurred at a cabin altitude of 26,000 feet after approximately $3\frac{1}{2}$ hours exposure. Ground level prebreathing of 100% oxygen was accomplished for approximately 40 minutes prior to take-off. He had opened his facepiece for a short period after approximately $2\frac{1}{2}$ to 3 hours of exposure at this altitude. The symptoms responded rapidly to manual pressure suit inflation to 1.0 to 1.5 psi above cockpit pressure.

B. This subject also relates a single previous episode of bends in the right elbow in 1963 during an altitude chamber indoctrination in the full pressure suit. History from chamber flight records is as follows: 19 March 1963 - After 3 hours 25 minutes at 26,000 feet, the subject felt faint symptoms of bends in left elbow. Then it became a dull sensation. Then throbbing with heart beat in the joint. Chamber altitude was lowered to 10,000 feet after 20 minutes and the pain immediately cleared up. The subject was brought back to 26,000 with no change. Gradually the feeling changed from sore to hurt. At this point the flight was aborted after 4 hours 45 minutes to preclude possibility of the bends recurring. Odd sensation on ground. OK to go (another chamber flight) day after tomorrow. Stomach was upset at start of run--subject had sausages for breakfast. Subject drank water during run (at 10,000 feet) and stomach was OK. Subject had headache after run. Note: Apparently 1 hour of prebreathing 100% oxygen was performed on all altitude chamber runs conducted during this period. However at least 5 individuals reported bends during one of their 3 to 4 chamber runs. This subject and one other (in same time period, ie, 18-22 March 1963) had bends which caused flight to be terminated. Three other cases, bends were tolerated or transient.

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C. The only other history of significance is that the subject has an old, asymptomatic athletic injury of the right knee, incurred in 1949.

D. One other comment of note pertains to this individual. Various individuals in the Life Support Section have stated to this reviewer that this subject, as compared with all others, objects to prebreathing the most and generally refuses to engage in denitrogenation prior to transfer to the aircraft. How accurate the reported denitrogenation times are for the most recent or even the past episodes is a matter of question in light of this individual's attitude and behavior regarding prebreathing.

3. Review of Information and Similar Cases from the Literature:

A. Symptomatology of Chokes: from Dysbarism, Aeromedical Review 1-64 USAF SAM, Feb. 64 by H.F. Adler.
There are 4 characteristics or basic criteria for recognizing true chokes. The severity of symptoms is as variable as in the case of bends. The symptoms may be intermittent but have a tendency to progress.

(1) Substernal Distress which may vary from a dry sensation in the chest to a burning, gnawing, sometimes lancinating substernal pain which does not, in the usual case, radiate to other regions. There may only be a sensation of fullness, sense of constriction, tightness, or oppression in the chest. The sensation has been compared sometimes with a burning or rawness similar to that encountered during running or heavy exercise in cold weather. The symptoms may persist for some time even after return to ground level, and residual chest soreness may persist for hours or days.

(2) Symptom of Cough varies from a desire to cough, which is controllable to a distressing paroxysmal cough which interferes with respiration and probably with cardiovascular physiology. Cough is usually rasping, hacking, and nonproductive.

(3) Aggrevation of Pain/Cough: At altitude, the substernal distress and cough are aggravated to a marked degree by attempts to perform physical exercise. Even attempts to take a deep breath cause a marked increase in chest symptoms and/or an intense desire to cough.

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(4) Difficulty in Breathing is accompanied by a sense of suffocation and apprehension. Breathing is likely to be rapid and shallow because of voluntary attempts to avoid painful deep breaths.

(5) Other Symptoms: With severe chokes cyanosis may be noted, but generally there is an intense pallor in severe chokes which may mask any cyanotic color. Along with pallor there can be considerable weakness and perspiration. Faintness and syncope are not uncommon in moderate to severe chokes. A marked feeling of fatigue after all other symptoms may have disappeared is a common experience during the period following return to normal atmospheric pressures.

B. Review of Cases:

(1) Aerospace Med, Dec 1966, Treatment of Altitude Dysbarism with Oxygen Under High Pressure - Report of Three Cases, McIver and Kronenberg, pages 1266 to 1269.

a. Case 1. 29 year old white male research subject. $1\frac{1}{2}$ hours prebreathing 100% O_2 at 14.5 psi. 35,000 feet for 1 hour on 100% O_2 - complained of mild shortness of breath during exercise associated with mild upper anterior chest pain which was worse on deep inspiration. Symptoms decreased until approximately 1 hour after onset when he reported feeling cold and clammy. Descended to 11,500 feet and examination revealed pulse rate of 100 with an occasional missed beat and moderate cyanosis of nail beds. After $5\frac{1}{2}$ hours at ground level (pulse rate and cyanosis remained) sudden onset of nausea, generalized weakness followed by loss of consciousness and grandmal seizure. Five hours after onset of first symptoms WBC was 18,300 and was 17,700 after $8\frac{1}{2}$ hours. Treated in Hyperbaric chamber.

b. Case 2. 36 year old white male research subject. $1\frac{1}{2}$ hours 100% O_2 at 12.7 psi (4,000 feet). After 1 hour at 35,000 feet subject had transient flash of pain at the base of left scapula. Three minutes later he noted sensation of needles all over his body and a cold flash across the anterior chest. Descent started with all symptoms gone at 24,750 feet. Descent stopped at 11,500 feet (still on 100% oxygen). After 14 minutes at this altitude

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patient noted mild right substernal chest pain, but did not report this for an additional 20 minutes. At this point the pain was severe, burning in character and accentuated by deep breathing. Coughing was a prominent symptom. Descent was made to ground level. Treated in hyperbaric chamber. WBC at 2 hours after onset of symptoms was 7,100 with no further follow-ups.

c. Case 3. 35 year old white male research subject. 3 hours prebreathing 100% 0_2 at 14.5 psi. After 2 hours 33 minutes at 35,000 feet, observers noted the patient's facial expression showed discomfort. Upon questioning he stated he was unable to catch his breath and was somewhat faint and dizzy. Also noted paroxysms of coughing and substernal pain on deep inspiration. Chamber descended to G.L. At G.L. subject's faintness and dizziness were gone but chest discomfort remained. Was extremely pale, anxious and somewhat cyanotic with blood pressure of 90/50 and pulse 56 (normal blood pressure was 120/70, pulse 56). Was treated in hyperbaric chamber. WBC at 3 hours after onset was 8,500 and was 5,700 after 20 hours.

(2) United States Armed Forces Medical Journal, Vol. X, pages 1 to 15, Jan 1959: Severe Dysbarism in Actual and Simulated Flight, A Follow-Up Study of Five Cases, Berry and King.

a. Case 4. 35 year old senior pilot, in-flight circulatory reaction after exposure to 29,000 feet for 20 minutes with symptoms of bends, chokes, fatigue and skin reaction (delayed). Moderately obese 71½", 183 lbs.
T-33 back seat pilot. 25 minutes after take-off at altitude of 35,000 feet (26,000 feet cabin altitude) began to experience pain in right lower costal area. Thought it was "gas"--climb continued to 37,000 feet. Then had pain in the left anterior axillary fold and above left knee and right elbow. Then had tingling in arms and hands. Took a deep breath of 100% 0_2 and within a few seconds developed a severe, dry, hacking cough. Descent to 30,000 with relief of respiratory difficulty but persistence of other pains. Descent to 13,000 feet with relief of all symptoms. After landing he felt unusually tired and had some residual soreness.

The next morning the patient noted nonpruritic, hive-like, red splotches in the same areas where he had previously experienced pain.

4. Notes on Seriousness of Chokes:

A. Neurocirculatory Collapse at Altitude by H.F. Adler, Special Project, USAF SAM, June 1950.

(1) In an estimated 1,000,000 man exposures in low pressure chambers to 30,000 feet or above there have been about 400 collapse cases of which about 150 could be considered serious. Of the latter cases, seven were fatal.

(2) 89% of the collapse cases are associated with bends, chokes, abdominal symptoms or various combinations of these three conditions.

(3) Of 314 collapse cases, 16.8% had bends and chokes as associated symptoms and 14.6% had chokes only as an associated symptom.

B. Dysbarism, Aeromedical Review 1-64, USAF SAM, Feb 1964 by H.F. Adler.

(1) True chokes at altitude should be regarded as a dangerous symptom, the gravity or potential seriousness of which requires immediate recognition and prompt action by the trained individuals in attendance. No case of true chokes should be regarded lightly and all grades are potentially dangerous, even after the individual returns to normal barometric pressures.

5. Summary:

While the subject did not demonstrate all the typical symptoms of chokes, his symptoms were very closely related. In light of the negative laboratory, X-ray and physical examination results, and his previous experiences with decompression sickness, this reviewer is inclined to believe that the subject experienced a moderate case of decompression sickness, specifically the chokes. The diagnosis of intercostal muscle spasm officially recorded cannot be disproven, nor can it be completely verified. Neither can the opinion of this reviewer be backed up by purely scientific data

regarding individual susceptibility except to state that the problem of differences in susceptibility is recognized, ie, to quote Adler in Dysbarism, "Differences in susceptibility to bends between different individuals, and even in the same individual on separate exposures, are often very marked."

6. Recommendations:

It has never been completely proven that there are "decompression sickness-prone" individuals, while it has been shown that decompression sickness can be produced under the right conditions in almost, if not all, individuals. Therefore it is not logical to consider grounding the individual involved at this time. USAF medical regulations concerned with grounding of pilots for incidents of decompression sickness, require permanent grounding only when neurological symptoms are involved. Short of such an occurrence there is no foundation for grounding this individual.

Decompression sickness can be prevented by adequate denitrogenation (ie, prebreathing 100% oxygen prior to flight) and as it pertains to this individual a stricter policy or procedure should be instituted in view of his experiences to date and the specific mission-related requirements involved. That is, because of this subject's past encounters with decompression sickness, loss of this individual on a future operational or training mission would be presumed, if other positive evidence was lacking, to have been caused by severe decompression sickness. Therefore for maximum protection of this individual and the program, a minimum of one full hour of uninterrupted prebreathing of 100% oxygen prior to take-off is the recommended denitrogenation regimen for all flights regardless of duration. It must be insured that the procedure is to have the subject suited and "on-the-hose" a minimum of one hour before the earliest anticipated take-off time.

If this recommendation is followed and the individual encounters another episode of decompression sickness in the future, re-evaluation by all knowledgeable representatives will be required before a new course of action can be recommended.